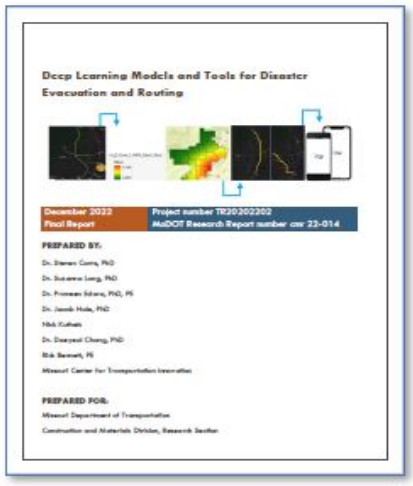
For more information contact: Brent Schulte (573) 526-4328

Research Summary

Deep Learning Models and Tools for Disaster Evacuation and Routing



Earthquake events cause economic and personal damages to people living in the earthquake-prone areas of Missouri. While there have been multiple studies done to analyze the impact level of an earthquake in various regions throughout the state, a connection between earthquake damage and accurate warnings to individuals near an earthquake event with suggested routes to evacuate safely has been lacking. In order to create a connection, this project focuses on determining the level of impact from an earthquake in a selected region within Missouri. The project also highlights the safest routes for individuals to evacuate the affected area or for emergency personnel to plan accordingly.

This research project used historic data collection, a first responders survey instrument, and determined road structure damage from the Modified Mercalli Intensity scale as the inputs into the traffic simulation models that encompassed the safest route for end users to take after an earthquake event. The route was then passed into the mobile application via a CSV file that could display the route to the user.

This study integrates visualization, prioritization, and simulation tools. Visualization tools harness the data from heterogeneous multi-mode sources and apply big data analytics and data management tools to provide geospatial and physical context for disaster response mapping. Prioritization tools integrate graph theory, impact models, and capacity models to design routing and resource allocation tools. Simulation tools were used to generate operational performance measures such as delays and clearance times for different traffic control situations during an evacuation.

> *"… a connection between earthquake damage and accurate warnings to individuals near an earthquake event with suggested routes to evacuate safely has been lacking."*

In particular, a traffic simulation model was developed to evaluate the performance of road networks under different evacuation traffic control measures. Performance measures such as delays, clearance times, and travel times were extracted from the model for various demand and traffic control events. The effect of different traffic control scenarios and network configurations were assessed using mesoscopic traffic simulation tools. From there, the simulation model provided the route(s) of choice following an earthquake for end users to use during evacuation in the New Madrid Seismic region (MO).

This project began with determining the location of interest that encompassed tasks one and two. This included gathering data from public data sources and completing a survey sent to first responders identifying roads of impairment post-

earthquake. From there, the Modified Mercalli Intensity scale provided further in-depth readings of structural damage from the area of interest, the New Madrid Seismic Region. The traffic simulations determined the safest route for evacuation, which was then fed into a mobile application for the end user to safely evacuate out of the region. Emergency personnel and civilians can use this application for effective emergency evacuation planning.

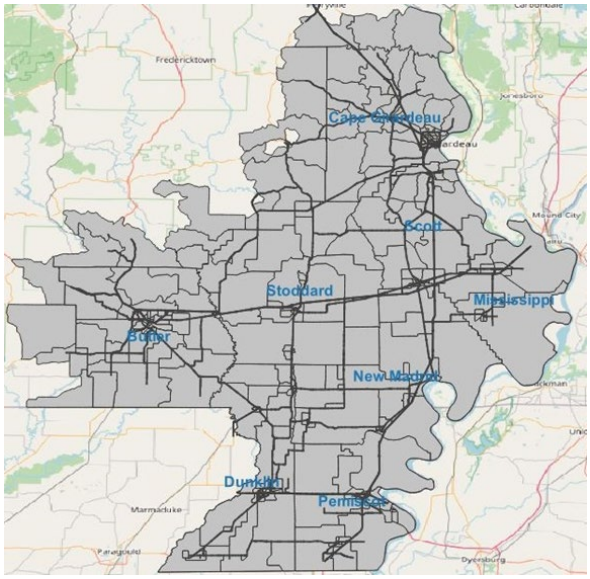


Figure 1: Study region consisting of eight counties in the New Madrid region.

Project Information

PROJECT NAME: TR202202—Deep Learning Models and Tools for Disaster Evacuation and Routing

PROJECT START/END DATE: January 2022-October 2022

PROJECT COST: $329,110

LEAD CONTRACTOR: Missouri Center for Transportation Innovation

PRINCIPAL INVESTIGATOR: Dr. Steven Corns, Dr. Suzanna Long, and Dr. Praveen Edara

REPORT NAME: Deep Learning Models and Tools for Disaster Evacuation and Routing

REPORT NUMBER: cmr 22-014

REPORT DATE: December 2022

Project Manager

CONTACT INFORMATION:

Brent Schulte
Intermediate Research Analyst
Missouri Dept. of Transportation
1617 Missouri Blvd.
Jefferson City, MO 65109
(573) 526-4328
Brent.Schulte@modot.mo.gov